TOTAL TRAIN SOLUTION ™

TTS meets the most demanding requirements

- **High quality hardware**
- **Field proven software**
- **User friendly interface**
- **Optimized visualization**
- **Technically expandable**
- **Detailed manuals**
- **Extensive services program**

Resulting in:

- **Minimum installation, commissioning and troubleshooting time**

Main features:

- **Compatible with several leading hardware platforms**
- **Steam turbine control**
- **Motor control**
- **Gas turbine control**
- **Compressor Anti-surge control**
- **Performance control**
- **Load Sharing**
- **Advanced Sequencing**
- **Embedded Model**
- **Mechanical Performance Monitoring**

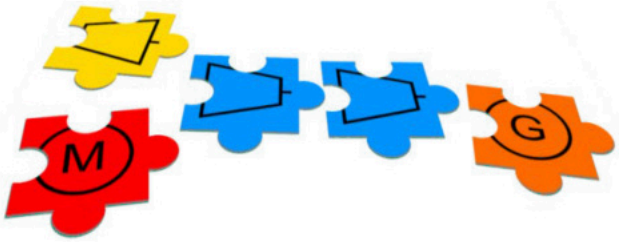
Introduction

Turner-ECS traditionally offered two types of technical solutions for the control of rotating equipment:

1 Standard solutions: These products are off-the-shelf turbines and compressors controllers. They are high quality and cost effective products. Reliable and easy to configure, they may not be able to control a full train and its auxiliaries. The extra functionalities needed must be implemented in an additional PLC or in the DCS system.

2 Engineered-to-Order solutions: Provides a full match to the customer requirements including any additional auxiliary functions. Such customized solution delivers an optimal control system but commonly increases the engineering time and cost.

The Turner-ECS Total Train Solution™ (TTS) now offers a third solution which provides the renowned reliability of the standard products while maintaining maximum flexibility to incorporate custom functionality into one control.



Product Summary

The Turner-ECS Total Train Solution™ is a controller platform for turbine or motor driven compressor or generator applications developed in Woodward GAP™ language. The TTS is intended for use on multiple Woodward hardware platforms and offers a mix of standard, configurable and programmable functions for control and visualisation.

The Total Train Solution™ is designed to control full train applications. It can be used for direct upgrade of many existing controllers. It supports up to five anti-surge loops, a performance loop, quench valve control and many auxiliary functions (e.g. generator applications).

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Direct upgrade for:

- CCC series 3
- Triconex
- 2301 old series
- Peak old series
- 505 old series
- 5009 old series
- PLC-based controls

Special points of interest:

- Retrofit solution for Non-Woodward and Woodward turbomachinery applications
- Enhanced anti-surge logic complying with major OEM and end-user requirements
- Features advanced steam turbine protection including
  - Steam Dew-point Protection
  - Delta Pressure Protection
- Features advanced motor protection including
  - Consecutive start protection
  - Winding temperature protection
  - Current monitoring

Background

Over time, Turner ECS developed a solid track record of successfully executed complex compressor control projects. As the Woodward Business Partner for Europe and the Middle-East, Turner ECS provides its local technical resources and unique expertise.

These last years, Turner ECS engineered and commissioned more than 75 compressors control systems for the major Oil & Gas and Petrochemical companies in the world. Various additional services where offered, to ensure parts availability and continuation of its local support during the lifecycle of the control system. Based on this solid basis the Total Train Solution™ platform was developed.

Product Description

The Turner-ECS Total Train Solution™ comprises the following components:

- A Woodward GAP™ based standard software application with an embedded dynamic model intended for off-line configuration and validation purposes.
- A Woodward Toolkit based graphical engineering tool intended for configuration, service and operation, including a dynamic compressor maps and a dynamic steam map.
- Standard documentation.
- Engineering services, hardware and HMI visualisation as per project requirements.

Key features and benefits:

- Developed based on standard field-proven logic.
- Compliant to most of the standard technical requirements of all major steam turbine and compressor OEM's, end users and EPC's.
- Revision controlled and managed software logic.
- Including many advanced control features and commissioning tools.
- Field configurable functionality.
- Mechanical Performance Monitoring™ for preventive maintenance.
- Eliminates the need for auxiliary functionality in PLC or DCS systems.
- Modular software architecture allowing the TTS to be tailored to the needs of the respective application by adding or removing logic blocks.
- Suitable for simplex, dual redundant and triple modular redundant applications.
- Reduced development and commissioning time.

The Total Train Solution™ achieves its flexibility by means of a dedicated configurable Cause & Effect matrix, a configurable logic resolver, several configurable sequencing functions, configurable core software and configurable Modbus®* listing.

Hardware Platforms

The Total Train Solution™ is developed for multiple Woodward hardware platforms. Depending on the specific process, the customer requirements, the I/O number and the redundancy needs, any of the following Woodward controls can be selected:

- **Flex 200** / **500**, Economic solution, suitable for use in redundant configuration.
- **Atlas-II™**, Programmable control with dedicated I/O.
- **MicroNet™ Plus**, Simplex control with modular CPU's and I/O.
- **MicroNet™ Plus**, Dual redundant control with modular CPU's and I/O.
- **MicroNet™ TMR**, Triple redundant control with modular CPU's and I/O.

* Modbus is a registered trademark of Schneider Automation Inc.

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Special points of interest:

- Includes oil skid protection and pre-lube sequencing
- Includes anti-choke logic
- Includes compressor load sharing
- Full dual redundancy capability with Flex series, including I/O redundancy through Ethernet Global Data (EGD)
- Supports many types of remote I/O
- Configurable Cause & Effects matrix for added flexibility
- Compatible with Woodward ProTech® overspeed systems
- Compatible with Woodward easYgen genset controllers

Application Examples

TTS-500 on Flex 500 platform
The TTS-500 makes use of the same platform as Woodward's 505D and 505XT products. It supports 2 anti-surge loops without need for extended I/O and can be offered optionally with an large screen.

TTS-550 on dual Flex 500 platform
This solution is using two Flex 500 controls which can be interconnected by means of a dedicated Field Termination Module to achieve dual redundancy at an attractive price.

TTS-5000 on MicroNet™ Plus platform
This SIL certifiable dual redundant platform is used in many industrial applications. It offers maximum I/O flexibility. The TTS-5000 is used as direct replacement of Series 3, 505, 505E or 505CC-2 when redundancy is required.

TTS-9000 on MicroNet™ TMR platform
This triple modular redundant platform is used in many critical industrial applications such as nuclear plants. It offers maximum safety and I/O flexibility. The TTS-9000 is used as an alternative for the Woodward 5009 family controls when anti-surge loops, auxiliary systems such as oil skids or seal gas systems need to be integrated.

All of these typical applications are based on the latest version of the TTS platform and compiled on project basis only. The principle of maintaining just one source object enables revision management and feature control which allows for retroactive updates for historical applications.

One of many success stories

For many years, S-Chem in Saudi Arabia suffered from the inability to optimize their control systems configuration affecting three of their most important compressors. Long start-up times, improper redundancy logic and deficient algorithms resulted in a significant loss of production.

By using the Turner-ECS Total Train Solution™, Turner was able to replace their existing controllers by a MicroNet™ Plus redundant controller which resulted in a 15% production increase and enhanced process control reliability. This configurable control was provided with a sophisticated Commissioning/Configuration Tool (CCT) and HMI interface with a dynamic steam map and dynamic start-up curve, which resulted in a highly satisfied customer.

Based on the success of this upgrade, this customer decided to upgrade the controls of their other extraction steam turbine controllers as well using the same technology.

"Once you know how to drive, you can drive any car. The same applies for the Total Train Solution™ platform, as soon as you know one product you know them all"
Jean-Philippe Monge (System Designer)

TURNER ENERGY CONTROL SOLUTIONS

WOODWARD Business Partner

TOTAL TRAIN SOLUTION ™

Rotating Equipment Control Solutions delivered across Europe & the Middle East

Turner ECS is an official Woodward Channel Partner with offices located in:

- The Netherlands
- England
- Germany
- Italy
- Abu Dhabi
- Qatar
- Saudi Arabia

Turner ECS also operates and manages an extensive network of official agents and Authorised Independent Service Facilities throughout Europe & the Middle East

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Turner ECS Range of Services

LSTK projects for Turbine & Compressor Retrofits and Upgrades

Turner-ECS delivers reliable retrofit solutions for a wide range of prime movers and other applications. This includes Turbines and Compressors.

Genuine Parts & Service Exchange

Turner-ECS has the largest stock of parts, service exchange governors and electronics in Europe and can provide a fast turnaround service.

Product Training

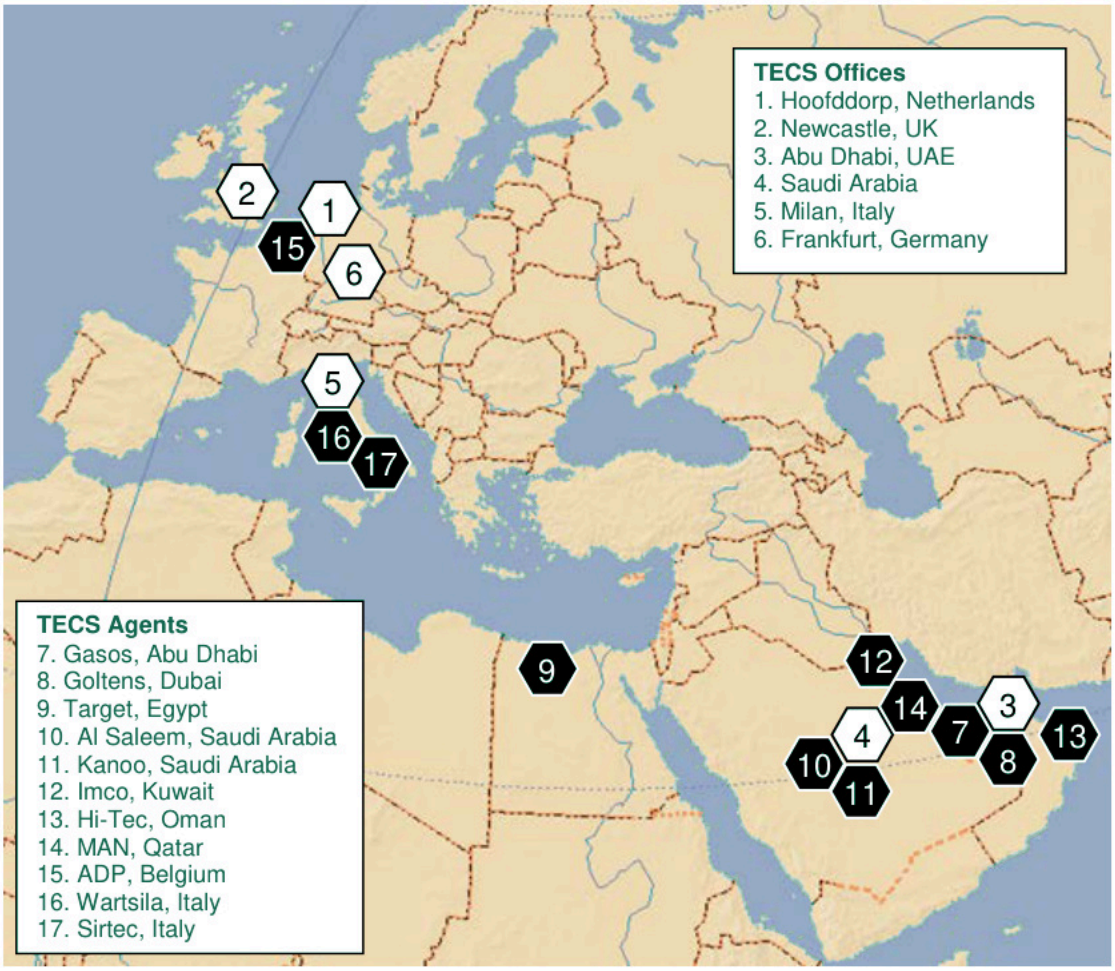
Turner-ECS can provide official Woodward product training covering both theoretical and practical training on a wide range of Woodward products.

Electronic & Mechanical Governor Overhaul Service

Turner-ECS provide a comprehensive overhaul and repair service for electronic, mechanical and hydraulic governors.

Field Service

Turner-ECS field service engineers and technicians provide comprehensive solutions for commissioning and on-site repair.

Service Contracts

Turner-ECS provide long term service contracts to support users with Woodward governors and/or control products and electronic controls.